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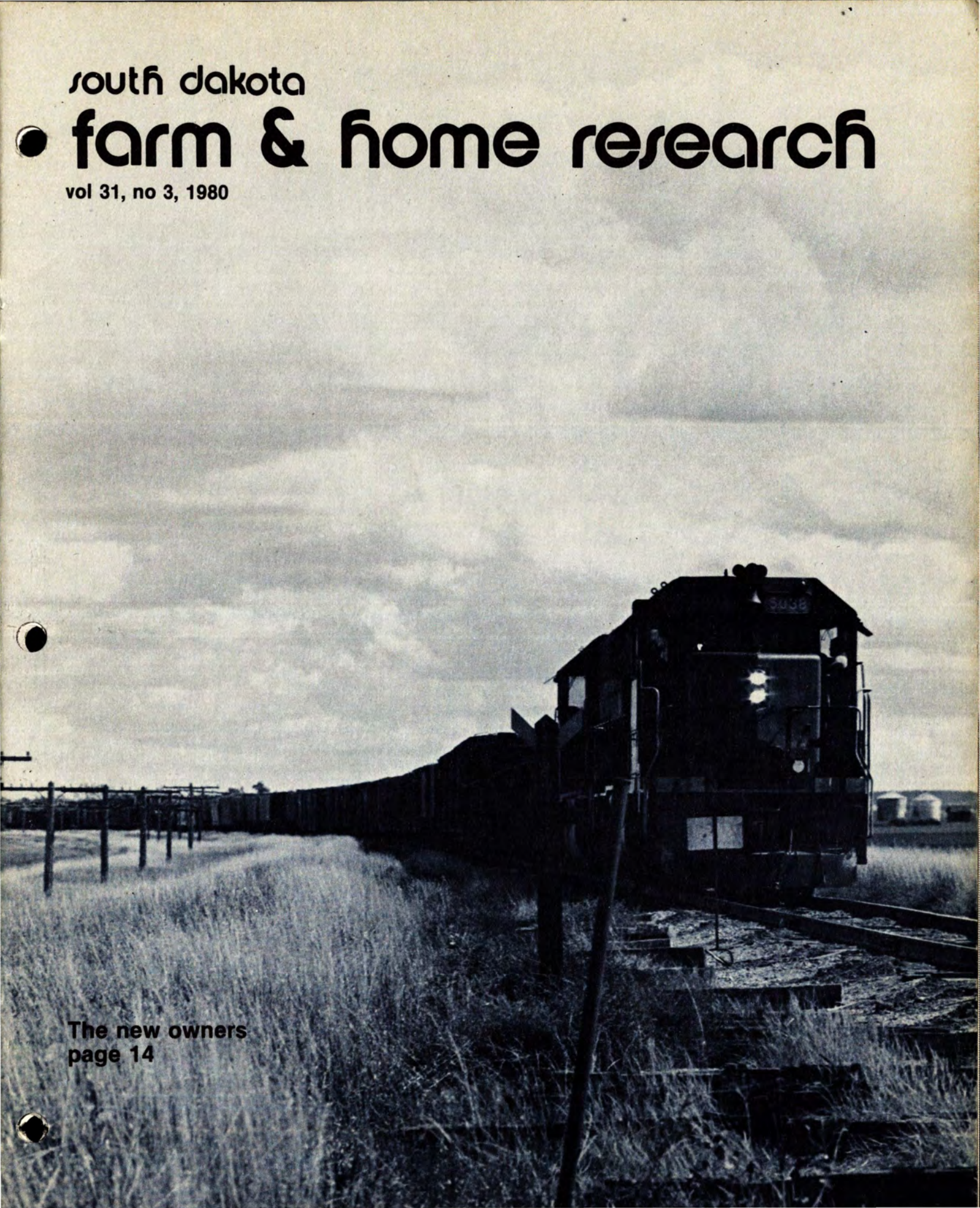

The new owners
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Director's comments

We're stuck with our soil and climate, but research helps us "make the best" of environment

Ray Moore
Agricultural Experiment Station

When we really analyze the factors that affect agriculture, in fact, our very lives, we find there isn't much we can do about some of the biggest and most important.

Some things we can't possibly change—the soil type that largely determines the crops we grow and the yield we get; the climate that dictates our growing season, the amount of useful precipitation, the combination of maximum and minimum temperatures we have to work with.

My point is that since there are some very important things that we can influence only minimally, we must really do the best we can in managing those things that are under our complete control.

If the farm had a silt loam when you bought it, it will still be a silt loam when you turn it over to the next generation. While it's yours, you learn to slow down your water application rates and to take advantage of its larger water holding capacity.

You learn to plant varieties that have been adapted for the climate in your part of the state. You control the number of trips you make across the field—even the direction—and plant cover strips since that finer soil tends to blow.

You can control weeds, time and rate of planting, fertilization. You can select dams and sires, build them housing against the climate, formulate rations and pasture selectively, market carefully. All these things are in your hands; research has put them there. Research has given us the opportunity to manage and change within an environment that resists management and change.

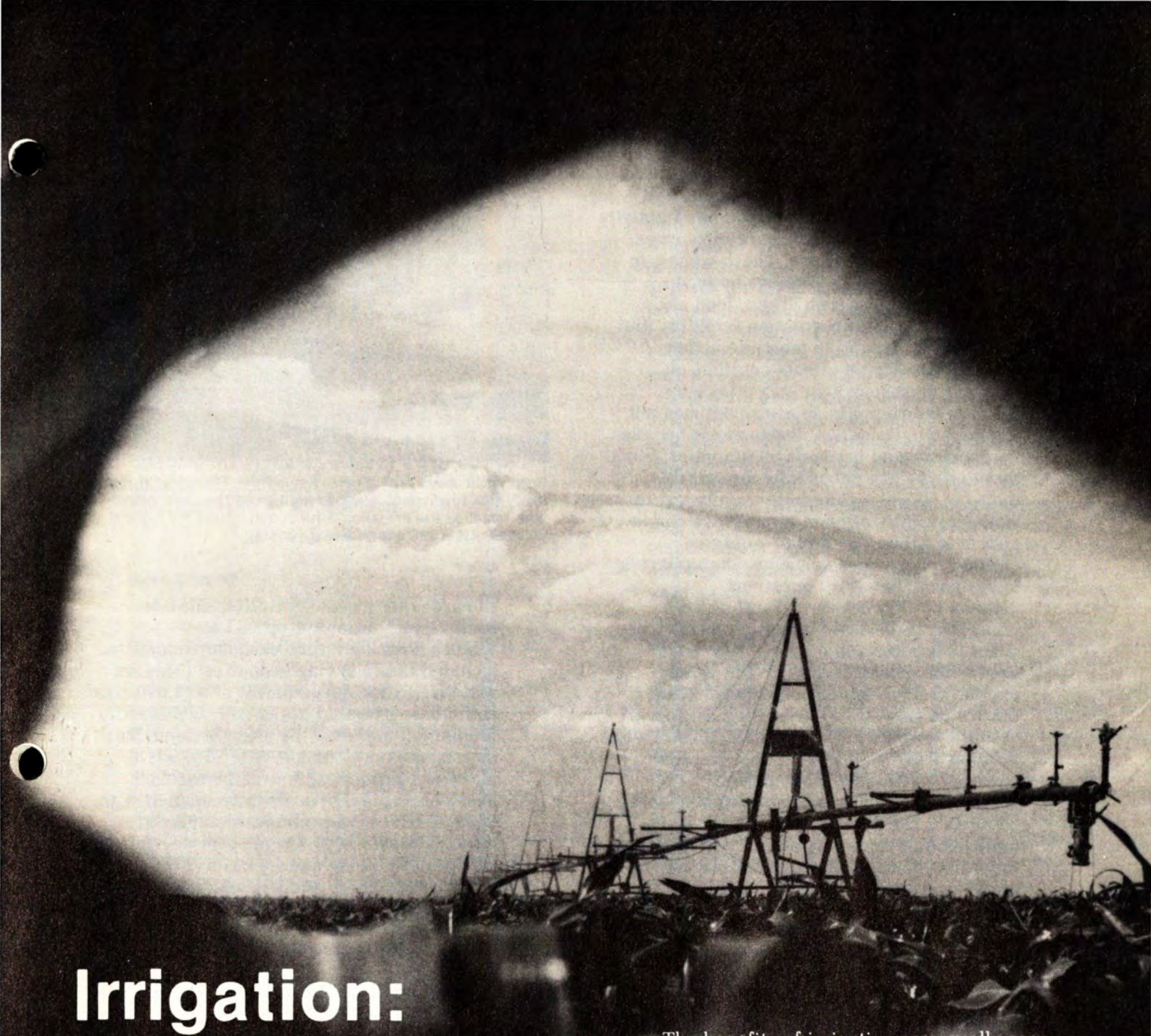
Other parts of our environment are more susceptible to change—our homes, our communities, even our relations with the banker. Research is helping you here, too.

In our homes, we can slow energy loss through windows with lined draperies. That was researched here at SDSU. We can make progress with our neighbors and in our communities by first understanding them—their backgrounds, their individual and our common concerns. It surprises many people that experiment stations such as ours do research in these areas. We should. Communities are a part of our environment.

If the environment in which you and your banker operate needs improving, the first thing you can do is to become a better farm manager, keep better books, make yourself a long-term management plan. Agriculture is a thinking man's occupation these days. We realize that. Actually, farm management is one part of the environment where change is the rule; our job is to keep you knowledgeable and flexible enough to adapt to new situations.

When we reconsider, it's amazing that there are so many ways we can move, given the soil, climate, and other factors we can change only minimally. Your Experiment Station is helping you make the most of the things you can control.

Our research won't change the silt loam on your farm. But we are committed to helping you make the best of your environment. That, really, is the reason for our existence. □



Irrigation: who profits?

"What if" a farmer starts irrigating. Who pockets extra cash? Your choices: a) farmer, b) townspeople, c) both

Richard Shane

Who benefits from irrigation development?

Are farmers the only ones who profit? Or do townspeople gain in the switch from dryland to irrigation?

The benefits of irrigation are usually seen as crop yield stabilization—dependable amounts of cash crops and feed supplies at higher levels than with dryland farming.

Whether or not this crop stabilization increases the farmer's profits depends on the final relationship between added revenues and the added costs of irrigating.

Even if the farmer's net income does not increase, other sectors of the economy benefit from the additional purchases necessary for irrigated compared to dryland farming.

For example, some irrigators use around 40% more fertilizer and 50% more herbicide and seed than dryland farmers. Irrigators must purchase more equipment and more repairs and borrow more capital than their dryland counterparts.

These expenditures by the farmer are direct benefits of irrigation to non-farm people. In addition, there are many "ripple effects."

Farm supply companies and farm product purchasing firms, the first to benefit, will expand to meet the increased demand activity from irrigation. They hire more employees, paying out more in wages. These wages, in turn, are spent on such things as food, clothing, and recreation. Then, food and clothing stores and recreation facilities find they need to expand to meet the higher demand. The ripple effects continue on through the region.

These indirect effects are sometimes not attributed to irrigation development because they are masked in non-farm activities. Since these effects are not readily measurable, their potential magnitude is usually left to conjecture. Any attempt to measure ripple effects is called "multiplier analysis."

One proven way to measure multipliers is to ask some "what if" questions.

Say a certain region of South Dakota undergoes large-scale irrigation development. What if farmers sell off their increased production as cash crops? What if they expand their livestock operations? What if there's no slowdown in rising energy costs?

In the language of economists, these "what if" questions are part of an econometric modeling technique. We choose a geographical region, select pertinent facts about that region, and design a set of mathematical equations which will measure the interactions of the regional economy. The model can then answer our "what if" questions.

Dr. Ralph Brow* and I designed such a model. It is flexible; when we come up with additional "what if" questions about future economic activity, they can be answered by the model.

Five possible "scripts" were prepared for Third District

What's returned to us from the model are possible scenarios, directions the economy might take in the future, given the information we fed into the model.

The study area was South Dakota's Third Planning District, which is a 12-county area along the Missouri River in south-central South Dakota. The area was divided into two sub-areas to account for differences in rainfall and dryland crop yields.

Both profit, says Dick Shane, Economics Department, but it's likely that townspeople will benefit more than the farmer who installed the irrigation if he doesn't push for highest yield to offset the added energy costs.

Some possible future economic conditions included the following scenarios: (1) large scale irrigation development of 425,000 good potentially irrigable acres with increased production marketed as grain or feed, (2a) large scale development with 25% of increased production marketed through livestock, (2b) large scale development with 60% of increased production marketed through livestock, (3) large scale development with rapidly rising energy costs (17% to 18% per year), (4) large scale development with technological advance (such as corn yields increased from 150 to 185 bu/A), and (5) large scale development with both rapidly rising energy costs and technological advance.

In all scenarios we assumed that irrigation water was available at the head of the field. Chase Econometrics forecasts for future farm input and output prices were used to project through 1983.

Before each scenario was completed, a **base** solution was derived which projects economic activity in the region from 1977 through 1983, holding irrigation constant at 1977 acreages. To assess the potential impacts of the various irrigation scenarios, we calculated changes in economic activity by comparing the values derived using the conditions of the selected scenario with the base values. The differences quantify the direct and indirect impacts of irrigation development. Changes in economic activity for the region are presented in Table 1 for each scenario. Now, let's discuss each one briefly.

*Professor of economics in the Business Research Bureau at USD.

Scenario #1

Irrigating 425,000 additional acres in the study region generated a $703.7 million increase in farm production over the period 1977 through 1983. At the same time, farm expenses increased by $680.6 million and net farm income increased $23.1 million.

Remember, this change in income was estimated by subtracting what farm income would be without irrigation development from what farm income would be with development.

Personal income in the region increased by $91.9 million. Over half, $50.3 million, went to non-farm people.

Total employment increased in the region by an average of 343 jobs over the 7-year period. Finally, as a result of the increased activity, South Dakota retail sales tax revenues rose by $9.9 million.

Scenario #2

Alternatives 2a and 2b assumed that increased production from irrigation was marketed partially through livestock, 25% in 2a and 60% in 2b.

In both scenarios, the increase in net farm income was less than if increased production was simply marketed as grain. With 60% marketed through livestock, the net farm income was $6.3 million lower than if no irrigation development had taken place.

In both scenarios, farm production and farm expenses increased dramatically. Farm production value did not increase as much as expenses because of the cyclical nature of livestock prices.

The large increases in production expenses indicated that farmers purchased substantially greater amounts of inputs than without irrigation development. Consequently, the economy of the region benefited even though the farmer didn't fare as well.

Non-farm personal income increased by $112.5 million when 25% of additional grain was fed to the livestock and by $141.1 million when 60% went to livestock. Non-farm income and wages paid to farm workers account for all of this increase. Even though farmer income declined, the direct and indirect impacts of increased farmer spending led to economic benefits for the entire region.

The state also benefited with this scenario, as retail sales tax revenues rose $13.3 million when 25% of increased grain production was fed to livestock. Finally, employment rose considerably compared to scenario #1 as farmers needed more employees to produce livestock and non-farmers needed more employees to supply farmer input demands and help farmers market their increased production.

Scenario #3

Since we seem to be in an "energy crisis," it was appropriate to simulate economic activity in the region if energy prices were to increase at an accelerated rate. Scenario #3 assumed a 17% to 18% annual increase in energy prices over the 7-year study period.

Farmers would be better off not to increase irrigated acreage under these conditions. Net farm income was $2.3 million less than if they continued dryland farming. However, the non-farm income benefits remained positive at $45.9 million.

Employment increased an average of 282 jobs. Many of these jobs would be on the

Table 1. Cumulative impact of alternative irrigation development scenarios, 1977-1983.

	Simulation Alternative					
Change in:	*1*	*2a*	*2b*	*3*	*4*	*5*
			$million			
Gross district product	255.5	299.1	363.2	217.3	575.6	501.1
Total employment (ave.)	343	379	435	282	792	696
Personal income	91.9	112.5	141.4	62.1	257.1	225.8
Non-farm income	50.3	101.7	74.5	45.9	78.8	77.8
Farm personal income	41.6	10.8	66.9	16.2	178.4	148.0
Farm proprietors' income	23.1	10.8	—5.9	—2.3	159.6	134.3
Farm production	703.7	1505.8	2627.9	703.7	840.3	840.1
Production expenditures	680.6	1494.7	2634.2	706.0	680.6	706.0
Net farm income	23.1	10.8	—6.3	—2.3	159.7	134.3
SD retail sales tax	9.9	13.3	17.5	7.9	15.4	18.5

1 = Irrigation of good potential land
2a = 25% fed to livestock
2b = 60% fed to livestock
3 = Rising energy prices
4 = Rising crop yields
5 = Rising energy prices and crop yields

farm as irrigation requires more labor than dryland farming. Finally, South Dakota retail sales tax revenue did not increase as much as with other scenarios, but it still rose by almost $8 million.

The results of this indicate that rising energy costs will definitely have a dampening effect on private irrigation development.

Scenario #4

Many individuals from seed companies, the university, and the farming community feel that crop yields will continue their upward trend. Scenario #4 incorporated yield increases into the future of the study region. For example, corn yields were increased gradually over the 7-year period from the current 150 bu/A average to 183 bu/A. Energy cost increases were held at a non-rapid increasing rate in this scenario.

With increasing yields per acre, farmers' productivity gains outreached cost of production increases, leading to a net farm income rise of $159.7 million over the dryland alternative. In this scenario, non-farm income also increased substantially at $78.8 million. This is the first scenario that resulted in income benefits of farmers exceeding income benefits of non-farmers.

Employment in the region increased an average of 792 jobs, the largest increase of all simulation alternatives. The state coffers, too, were enhanced with a $15.4 million sales tax revenue increase. The results reflect the "good times" for farmers and non-farmers suggested by the conditions of this scenario.

Scenario #5

The alternative of rising energy costs, while holding yields constant, seemed as pessimistic as the alternative of rising yields while holding energy cost increases down seemed optimistic.

Therefore, Scenario #5 incorporated both rising yields and rising energy costs into the model.

The productivity gains were sufficient to outweigh cost of production increases. Net farm income was increased by $134.3 million compared to dryland farming of the acreage. Again, farmers' income benefits from irrigation exceeded the non-farm income benefits by almost 2 to 1. Total employment increased by an average of 696 jobs and the state sales tax revenues increased by $18.5 million.

As long as farmers can continue the current trend of increasing yield per acre, rising energy costs can be offset. However, farmers content to continue to produce 150 bushels of corn per acre under irrigation are going to see profits decline and probably disappear completely.

Plug in your figures at risk; you could overlook something

Based on the results of this study we can make a number of conclusions.

Irrigation development will have positive short- and long-run impacts on the farm and non-farm sectors of the regional economy studied. But if economic conditions do not allow for yield per acre increase, non-farm benefits will exceed farm income benefits.

Rapidly rising energy costs will offset positive farm income if technological advances do not either increase yields per acre or reduce costs per bushel produced.

Large increases in livestock production as a result of increased feed availability from irrigation are not likely.

State sales tax revenues will increase with irrigation development.

You are left to draw your own conclusions, depending on your estimate of future economic activity in the study region. If you do not agree with any of the projected scenarios for the region, you can try to insert your own figures, but use such estimates cautiously, as many interactions occur in a complex economy that you would possibly leave unaccounted. □

The author is Dr. Richard C. Shane, assistant professor of economics at SDSU.

New N test in the works

First-time irrigators might be throwing money away; there's more N in soil than present tests catch

Nitrogen is up 70% and the interest rate is up 100% in the last 2 years. The situation calls for better management.

That's not news. But when a researcher has found or is looking for a method of "fine-tuning" a management practice—that's news. That's going to save you money.

"The goal of our soil fertility research is to better evaluate the fertility level in soils," Paul Carson, SDSU plant scientist, said. "We want to determine the management techniques which will allow the farmer to attain his optimum yield goal at the lowest cost."

Nitrogen is one of the elements essential to plant growth and is required in larger amounts than any other element absorbed from the soil. It is usually the element most likely to limit production if fertilization is not practiced, and it represents the largest total cost when fertilizing.

The nitrogen utilized by plants other than soybeans, alfalfa, clover, and other legumes comes mainly from three sources: fertilizer, nitrogen left over from the previous years, and a natural soil process called mineralization—the release of inorganic nitrogen from decaying plant and animal residues in the soil.

Present soil testing procedures can accurately measure the amount of residual nitrogen present in a soil but, to determine the amount of fertilizer to be added, the nitrogen supplied by mineralization and the total amount of nitrogen needed to produce the crop also must be predicted.

When land is newly irrigated, mineralization rate speeds up

Dwayne Beck, a graduate research assistant at SDSU, is in his second year of gathering data necessary to develop a soil test that will predict the amount of mineralization that occurs on land planted to corn under irrigation.

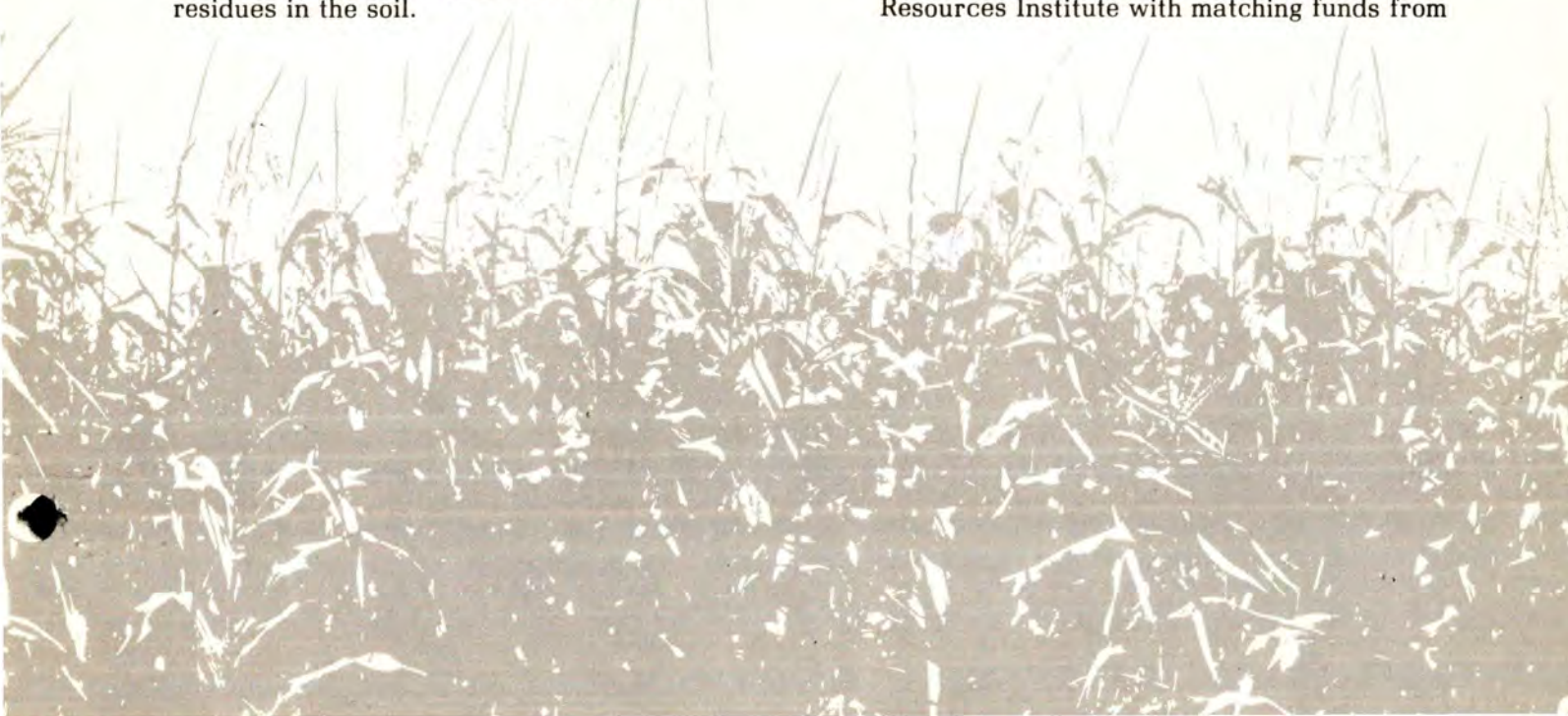
Beck is studying irrigated land because such conditions favor mineralization. Much land is being broken from sod and irrigated for the first time in South Dakota. The potential for mineralization is very high both on new lands and lands under irrigated culture.

Because of the relatively cool and dry climate, South Dakota soils have built up from 2 to 4% organic matter that breaks down into nitrogen more rapidly when under irrigation. The rate varies according to how many years the land has been irrigated.

"Since farmers have their land and equipment to pay for anyway, they might as well get the highest possible production," Beck said. "The only way to make ends meet in the future is by maximizing production while minimizing production costs.

"If we don't consider mineralization, we are putting on too much nitrogen and we are tying up dollars that we don't need to."

The study, which began early in 1979, is financed by the South Dakota Water Resources Institute with matching funds from



"Faked steak"

Cheaper beef is cut into particle sized bits, pressed back together. Product "passes" as a ribeye steak

Steve Seideman

The meat industry is experiencing a modernization phase. More new products and processes are being investigated than ever before.

The goal of all this activity is to adapt to the changing lifestyles and attitudes of Americans—to meet new demands that will ultimately help both the packer and the producer receive a greater profit.

An estimated one out of every two meals is consumed away from home. The hotel, restaurant, and institutional trade and fast-food restaurants are absorbing the demand.

These industries prefer food that is uniform in weight and shape so the cooking procedure can be standardized. Traditional steaks vary extensively because of animal variation.

But restructured or flaked and formed steaks fit industry requirements and are presently being used by these types of establishments.

Restructured products make a wider selection available to the consumer, increase the value of less desirable parts of the meat supply, and increase returns to meat processing and livestock production industries.

Patty Durland, Britton, is one of five food science majors working with the Animal Science Department in this research. She is quick freezing the meat with liquid nitrogen.

Restructured steaks are only one method of processing meat. Bill Costello, left, and Steve Seideman examine a carcass that has been electrically shocked. The method increases shelf life, tenderness and flavor, and reduces shrinkage. The animal scientists are also working with poultry meat.

"Fabricating" steaks is new area with industry "secrets"

Although this procedure has been researched for lamb and pork, until now no university has earnestly attempted research in the area of flaking and forming beef. A few industry organizations are presently producing restructured steaks, but their procedures remain industry secrets.

Dr. Bill Costello* and I are supervising research in the Meats Section of the SDSU Animal Science Department aimed at perfecting the restructured steak concept with beef under a research grant from the South Dakota Beef Industry Council. The research began last summer and will be complete in the spring of 1981.

Restructured steaks are made by flaking less desirable frozen cuts of meat through a special machine and later pressing the meat chunks back together in the shape of a ribeye.

One company even has a machine that can put a layer of fat around the restructured steak.

The procedure begins by coarse grinding the meat to be used. The meat is frozen and then passed through an Urschel Comitrol which has an impeller that throws the frozen meat against a series of blades mounted on a stationary head, cutting the frozen meat into wafer thin slices that allow the meat to bind well together.

The meat is then mixed so salt or any other flavorings can be added. The flaked and mixed meat is formed into a log, frozen, brought to temperature, and pressed at 250 to 400 psi

*Associate professor of meat science, SDSU.

Biggest users of processed meats are the restaurant and fast food trades, which serve one out of every two meals people eat. These industries want meat that is uniform in weight and shape.

into a shape similar to a ribeye. The pressed log is refrozen and subsequently cut into ¾-inch steaks.

The product works well in the hotel, restaurant, and institutional trade but is not as well accepted in retail stores. Most consumers want meat to be bright red; and since restructured steaks are sold in the frozen state, they are a dull, off-color reddish-brown.

Perfecting the process for beef requires answers to many questions. Does meat temperature before flaking make a difference? What are the best flaked particle size, mixing time, and amount of additives?

Home ec students helped in restructured steaks research

A number of undergraduate students from the SDSU Food Science Department have assisted in conducting these experiments and all happen to be from South Dakota: Patricia Durland of Britton, Joelene Michels of Chamberlain, Barbara Noble of Huron, Kathy Wing of Dell Rapids, and Pam Price of Brookings.

The various methods of flaking the meat were investigated. We compared meat flaked at 20, 28, and 36 degrees F to both sliced and formed meat and ground meat. Taste panels determined that flaked meat, irrespective of the temperature, was more desirable than ground meat.

Meat sliced on a bacon slicer and formed into steaks was compared to actual chuck steaks and to flaked and formed steaks. Taste panels prefered sliced and formed beef to flaked and formed steaks or chuck steaks.

Taste panels also compared restructured steaks from steers to those from cow meat. The meats had various levels of salt and HVP (hydrolyzed vegetable protein—a flavor enhancer). The results show that people do not care for cow beef that contains less than 1% salt and 0.25% HVP. These ingredients are recommended for restructured steaks made from cow beef.

In examining flaked particle size and mixing time, it was found that restructured steaks should be made with particles less than ½ inch in diameter and mixing time should be less than 10 minutes.

Restructured steaks from beef rounds 3 hours after slaughter—before rigor mortis—were compared with restructured steaks from meat 3 days after slaughter, the normal aging time. The flavor was not as good when pre-rigor meat was used, but the color was much better.

In comparisons of steaks containing 16, 20, and 24% fat, taste panelists prefered meat with 16% fat.

How to cook restructured steaks may be next thing to work on

These six projects represent a lot of work, but there is still more needed. The cooking procedure is not yet as refined as necessary. To some extent, the cooking procedures now being used may actually detract from the eating quality of restructured steaks.

To this point, it is believed that flaked and formed steaks are between ground beef and actual steaks in eating quality. It has been shown in these experiments that sliced and formed steaks more nearly simulate the actual eating qualities of real steaks and are usually preferred over real steaks from similar quality meat. Flaking and slicing are both methods that can be used to increase the tenderness of meats to make high quality formed steaks. □

The author is Dr. Steve Seideman, assistant professor of meat science, SDSU.

The new owners

Maybe we aren't so crazy after all; we have one more chance at devising a road-and-rail system

South Dakota might spend as much as $25 million for the purchase of some 1,254 miles of railroad during 1980. The expenditure is a result of legislative action creating the South Dakota Rail Authority and instituting an additional one-cent sales tax to finance it.

Large undertakings like this spawn many questions—questions covering a wide range of subjects and requiring a wide range of expertise to answer.

***Farm & Home Research** spoke with SDSU economist Charles Lamberton, who has spent much of the past 5 years studying, researching, teaching, and counseling in the area of transportation. The conversation gives his insights into the implications of the rail plan and touches on his present and forthcoming transportation research.*

F&H: Does the public understand this rail plan?

Lamberton: Most people do, generally; but I think many have a hard time understanding how the rail plan benefits them directly.

F&H: Those in agriculture are directly affected, however. Do you think most of them have a "handle" on the plan and what it means to them?

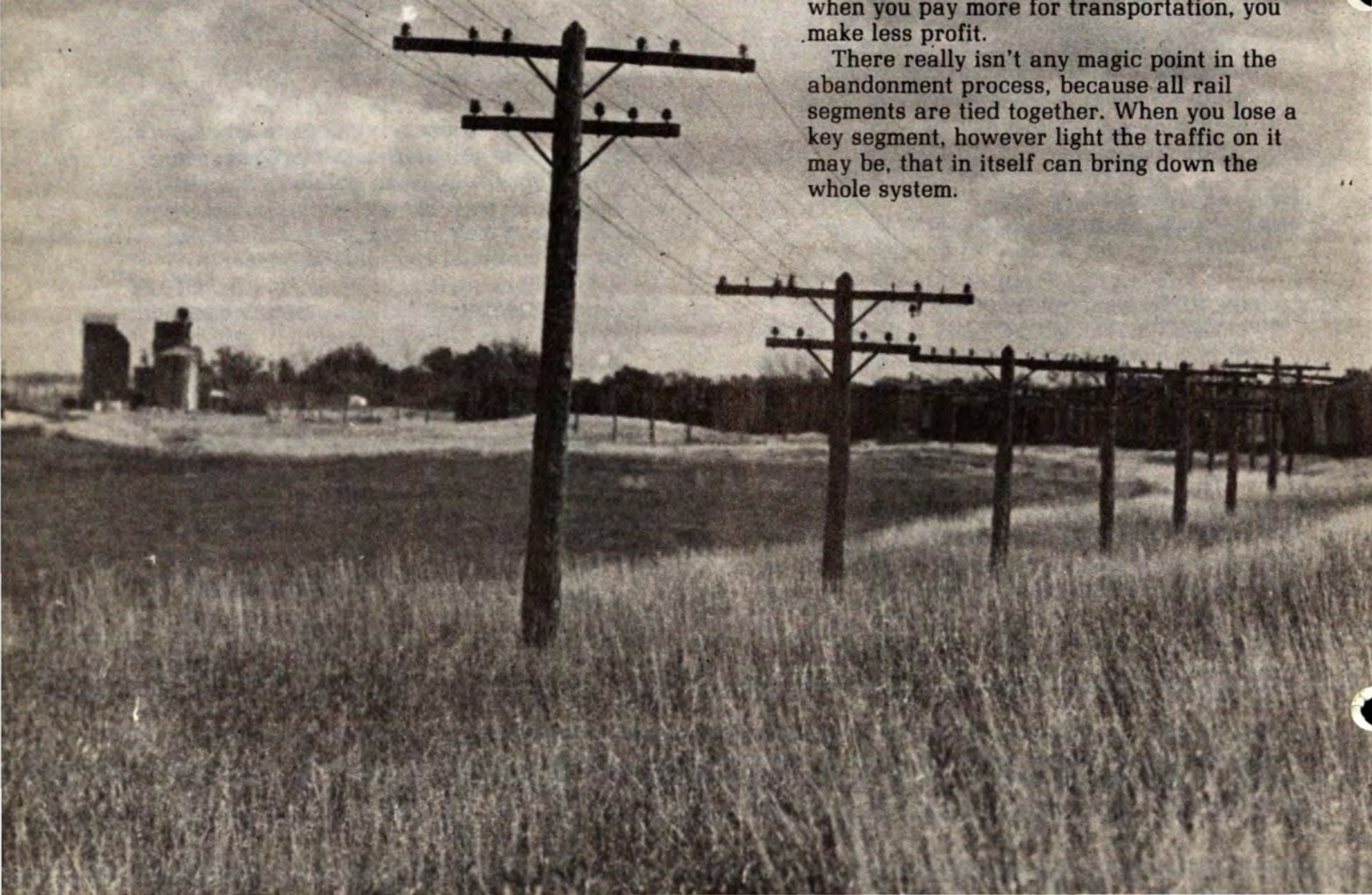
Lamberton: Farmers understand that more efficient transportation means higher net returns to producers. At issue is the distribution of benefits and costs.

For example, where rail service already has been lost and grain transportation has been shifted to trucks, people may perceive little direct benefit. These people will be benefited indirectly through the operation of the marketing system. The group perceiving the most direct impact—and therefore the group expressing the most concern—has been the rail shippers.

F&H: Is there a point of no return on abandonment, a point beyond which the economic roof falls in?

Lamberton: Should we ever lose our rail system entirely, we would survive through other means of transportation. But the reason we need the rails is that the alternatives are simply more costly in many instances. And when you pay more for transportation, you make less profit.

There really isn't any magic point in the abandonment process, because all rail segments are tied together. When you lose a key segment, however light the traffic on it may be, that in itself can bring down the whole system.



F&H: How did South Dakota get into this fix in the first place?

Lamberton: Historically, early transcontinental rail systems were placed across Nebraska and North Dakota. By the time the Milwaukee Road completed its route across South Dakota to the Pacific in 1910, earlier lines and the Panama Canal had captured the market for transcontinental traffic. Thus, our rail system is not supported by any through traffic. The Milwaukee has subsidized our light-density rail from the profitable high-density rail segments in other states.

We've also used a value-of-service rate making principle, charging a rail rate based on the value of the product being shipped. Bulky, low-value products like grain have been moved at lower rates than manufactured products. The result has been that agricultural lines have been relatively unprofitable.

Further, grain movement is seasonal, while manufactured products tend to move at a more even pace. Interest and upkeep on cars and rails continue the year around regardless of amount of use.

Agriculture here has been encouraged by the relatively low rates, but industrial development may have been discouraged.

Processing of agricultural products in our area may have been held back, partially because of the rate structure. That is, it has been more profitable to process the agricultural product elsewhere.

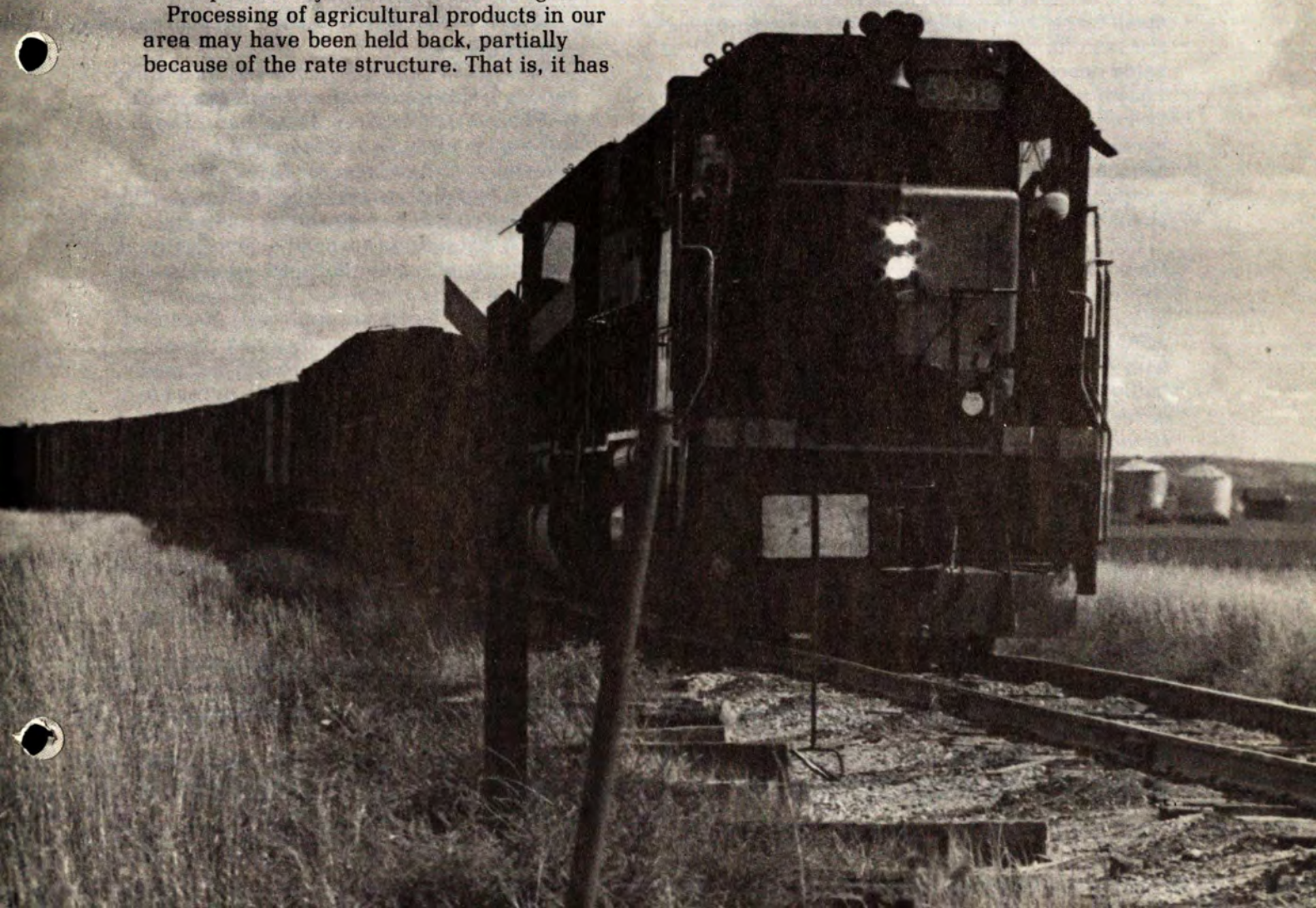
F&H: What role has the trucking industry played in the rail crisis?

Lamberton: The trucking industry enjoys certain advantages over rails. Service is faster, more reliable, and more responsive to changing shipper needs. Grain trucking rates are not rigidly regulated but flex with changes in demand for service. It is easier, compared to railroads, to get in and out of the business without huge capital investments.

In good crop years, when grain shippers can't obtain all the cars they want, the trucking industry expands. When there's a poor crop year, and less demand for transportation, truckers can lower their rates temporarily and haul as long as they cover their variable costs.

Rails are at a disadvantage in both kinds of years. Rail rates are regulated, so both rates and service can't adjust to demand changes.

F&H: It seems to be a "catch-22" situation. The rails haven't found this area profitable partly because of the absence of



manufactured goods to ship, and we haven't got the manufacturing partly because of the transportation rate differences. We also don't have manufacturing because of our small population and markets and we haven't got the population partly because of our lack of manufacturing.

Just what is South Dakota's place in the sun, and what is the prognosis for our future?

Lamberton: We'll have businesses, when and if it is cheaper for them to locate here than to ship raw products elsewhere. We'll always have a transportation system, because we have to move our products.

Our challenge is to see that it's efficient—whatever form it may take.

Take highways, for instance.

I think we'll see some roads abandoned altogether, other changed from one type of surfacing to another, and perhaps some reserved to just certain types of traffic.

The cost of concrete and petroleum based road surfaces has skyrocketed, and we won't be willing to afford certain kinds of roads unless the traffic demand really justifies it.

F&H: Is this the same approach we'll have to take with regard to our rail system?

Lamberton: Yes, it is, and it involves not only matching the lines to the demands, but much more. For instance, I think we might see some of the light-density branchlines being operated by the shippers themselves. They'll invest just like they invest in a truck or some other expensive machinery; not because a line in itself makes a profit, but because it may be the lowest cost tool available to continue in the grain marketing business.

I think we'll also see elevators and other kinds of shippers banding together to build strategically located grain subterminals; and in some instances, local elevators will emphasize cleaning, drying, and handling, with final delivery to the larger loading facility by truck. Local elevators may concentrate more on the farm supply and service aspects of their business.

Loading terminals permit us to use more economical unit trains of 25-50-75 cars.

So there'll be more short-haul than long-haul trucking. Trucking revenue may not be affected in a serious way, but truckers may spend less time away from their homes overnight than they do now and they won't have so much layover time waiting to be unloaded.

F&H: If the economies of the situation will eventually force these changes anyway, why is the state now intervening with funds for rail purchase and rehabilitation?

Lamberton: What has happened is that the Milwaukee Road, which owned about half of the track in the state, has had a total collapse; it went bankrupt.

The background is that the Milwaukee's transcontinental route probably never should have been built. By 1910, there was not enough potential economic growth between Minneapolis and the west coast to support the line. It has been an albatross to the Milwaukee Road ever since.

A coincidence is that the Burlington Northern route just happened to pass through an area which became the coal fields. If the circumstances were reversed, the Milwaukee might have survived.

Over the years, the Milwaukee went bankrupt three times, but each time reorganized and continued—until this last time, December 1977. Then, they asked permission to embargo service on many of their lines, including South Dakota.

It was a new route to go, where normally they might have asked for abandonment which takes more time. An embargo would halt service immediately and stop the cash drain.

They would have stopped service on the main line through Aberdeen too, but the state delayed that by using federal monies to help rehabilitate that line and keep the coal trains moving through 1979.

So, back to your question—you have this sudden collapse, and almost half the track will be gone if the state doesn't act. The embargo is already in effect, and abandonment has been requested. When abandonment is granted, the Milwaukee then can begin picking up the track and selling the land. When that happens, it's gone for good.

So, in some sense, the state is purchasing these lines as a stopgap.

The State Division of Railroads identified 429 miles of Milwaukee track as critical to the core system—lines South Dakota must have in the long run to maintain access to national markets.

The remaining 800-odd miles which might be purchased are not so critical to the rail system that the state must necessarily purchase the lines. However, they may be very important to the users on those lines. Those users now will at least have a chance to retain service on those lines at their own expense after the state has purchased the lines.

Only if the users organize and actively find ways to have service on those lines will there be service.

F&H: Just what is the core system; where is it located?

If a road-and-rail plan were to mesh, trucks could haul shorter distances than they do now and spend less time in layovers. Trucking revenue would not be much affected.

Lamberton: The system assumes that service will continue on the Milwaukee mainline from Minneapolis to Miles City, Montana. This would keep the coal moving to the plant at Big Stone and allow our grain to reach the west coast by changing to the BN at Miles City, or to go east on the Milwaukee to Minneapolis, Duluth, or Chicago. Also, our fertilizer could come in by these same routes.

Based on that assumption, the core system extends from Aberdeen south to Wolsey, Mitchell, Yankton, and Sioux City, and then from Chamberlain east to Mitchell, Canton, and north to Sioux Falls.

That system would provide connections to the Milwaukee, the Chicago and North Western, and the BN at Aberdeen, CNW and BN in the southeast, the Milwaukee across Iowa at Canton, and the ICG, BN, and CNW at Sioux Falls.

So the core system retains the ability to move grain in various directions.

F&H: After the acquisition of the track, what's the next step?

Lamberton: The plan is to invite proposals from potential operators, and choose one to operate the core system on a contractual basis.

F&H: Assuming the core system is in place and operating, is there a chance of some benefits that we may not have had before?

Lamberton: One is the potential growth of the export market through the west coast. South Dakota's corn production would be the closest to the market if that happened. In the past, Iowa has always had the closer location to the market and the cheapest cost for transportation. Now, this could be reversed.

F&H: In terms of the real estate and equipment involved, is South Dakota paying for some "blue sky" in buying this core system?

Lamberton: Remember that owning the lines isn't the same as operating the lines.

South Dakota is actually buying real property, and it's buying it at salvage value. That minimizes any investment risk. If the whole idea flopped, the state could recoup its investment and possibly a profit, just by salvaging the track and selling the land.

Further, some of the rail might be used to replace worn-out rail in other parts of the system.

Overall, the salvage value of the steel and land could reach as high as $25,000 per mile in some areas. That's at today's prices; it could go up if inflation continues. On the other hand, our cost for buying it will average about $20,000 per mile.

F&H: So the fear among some people that this is a poor investment for the state hasn't much basis in fact.

Lamberton; Right, and there are a couple of other fears that fall into the same category. One is that the state will continue to purchase track.

There are only about 2,500 miles of total track in the entire state, and the proposed purchase represents about half of it. If the state were to buy the whole system (and it won't), it couldn't cost over $45 to $50 million. This purchase, in other words, isn't the tip of the iceberg; it's the bottom of the iceberg.

Another worry is about operating costs. The state isn't going to hire train or section crews; it will contract for operation. The state will use its federal rail funds to rehabilitate the core system, but traffic will support the operating costs.

This is not to say that some subsidy may not be necessary.

The legislature has not addressed the issue of any need for an operating subsidy or how it would be financed. If I had to guess, I would predict that the funds for any subsidy would come from a combination of producer and shipper taxes such as one cent per

bushel produced or $100 per car shipped. It would probably not rely on the one-cent sales tax increase. That is a one-time tax to purchase the roadbed and rail before they are gone.

Some segments of the line may indeed be profitable—not profitable enough for the Milwaukee, but enough for South Dakota.

Some segments might show an operating profit under modified work rules rather than the national work rules now governing the Milwaukee. An employee might serve on a train crew today and a track crew tomorrow, for instance.

Some branchlines won't be profitable no matter how you operate them. In that case, you may have to view that line as a necessary working tool, a means to do business. It occasionally may be cheaper to use trucks, but the shippers have to take the long view.

If rail service is necessary to them, they'll have to use it consistently, and not just when it is most convenient. You can't do that and expect the railroad to be there tomorrow.

Some commitment, whether investment, traffic guarantees, or some other kind of arrangement—even ownership—may be necessary on the part of shippers.

Shippers in the past have had the incentive to maximize short-run profits, because railroads would be there, one way or another. Now, shippers will have to look at profits over the long run. If the railroad is an essential ingredient in their business, they'll just have to use it more consistently than they have in the past.

F&H: So it's a new incentive system?

Lamberton: That's right. And it also applies to the supply of cars. If we can smooth out the flow of our grain, our car availability problems should diminish.

If you are a shipper and also part owner of a railroad with its own cars, the incentive will be for you to keep those cars busy. Maybe the decision will be to store some of that grain a little longer to coordinate the shipping.

We may want to provide some incentive for people to invest in the construction of these large loading terminals.

F&H: What changes could all this bring about in the state?

Lamberton: Most of the labor on the system will be provided by South Dakota citizens, and a related benefit is that lines are apt to be better maintained as the focus is shifted to long-term rail service.

It may be economically feasible for the state cement plant to begin casting concrete ties.

Then there's the possible opening for more short-haul trucking from outlying elevators to subterminal loading facilities. Rail car repair may be another area of opportunity.

F&H: What research has been done, and what needs to be done?

Lamberton: South Dakota's situation is unique. No other state has experienced the same conditions and the same crisis. Therefore, other research isn't much help to us. We've got to do our own.

One thing that needs to be researched is whether it is cheaper to give some subsidy to the lines instead of paying for the increased road maintenance that more grain trucking would require.

We need to analyze the potential operating configurations for various rail segments to find out which can survive if the shippers want to commit to them. These studies are being conducted now for several branchlines and will be ready this summer. They are financed by a grant from the US Department of Agriculture, which made the grant in March.

A 2- or 3-year project will be to find a feasible combination of rail and highway system for the state with appropriate locations for subterminal loading facilities.

Highway maintenance costs, designating certain roads for certain purposes, and related studies also are ahead.

Manpower is something of a problem with all these research missions, but the greatest challenge is in obtaining the right data. The scene changes so rapidly that data is obsolete before it is available.

All the projects are geared to one end: finding the most efficient way to use our transportation resources and yielding the greatest return for the shippers, producers, and others who depend on the system.

The taxpayers of South Dakota are buying another chance to enhance our transportation system. It's important to make the best use of this opportunity. If we fail now, we may never have another shot at saving our rail system. □

Charles Lamberton is associate professor of economics at SDSU. **Farm & Home Research** *was represented by Larry Tennyson, agricultural information specialist.*

Seed testing lab

You can count on the results you get back from them. Did you send in equally reliable seed samples?

Only one year ago, South Dakota had one of the most lenient seed laws in the nation. Wheat seed containing 500 wild oats per bushel and alfalfa containing 2500 dodder in a 50-lb sack could be sold bearing a clear label.

Other states were dumping their bad seed into our state.

Because of the emergency seed bill that passed the state legislature on January 31, South Dakota's law now ranks among the best. One of the major provisions of the law is that all restricted noxious weed seed must be indicated on the label of any seed sold for planting.

Dr. Al Lunden, who is in charge of the SDSU Seed Testing Laboratory, expects farmers will be able to get a better price for seed sold out of state and the change will upgrade the quality of seed sold in South Dakota.

The law will mean not only a change for the seedsmen, but for the Seed Testing Lab as well.

Reliability of test depends on sample farmer sends in

The most frequently requested tests at the lab are purity and germination tests because they provide information required for labeling seed. But the purity test, which measures the percent of pure seed, weed seed, other crop seeds, and inert matter, is performed on a very small sample. Weed seed could be present in the seed lot, yet not show up in the sample.

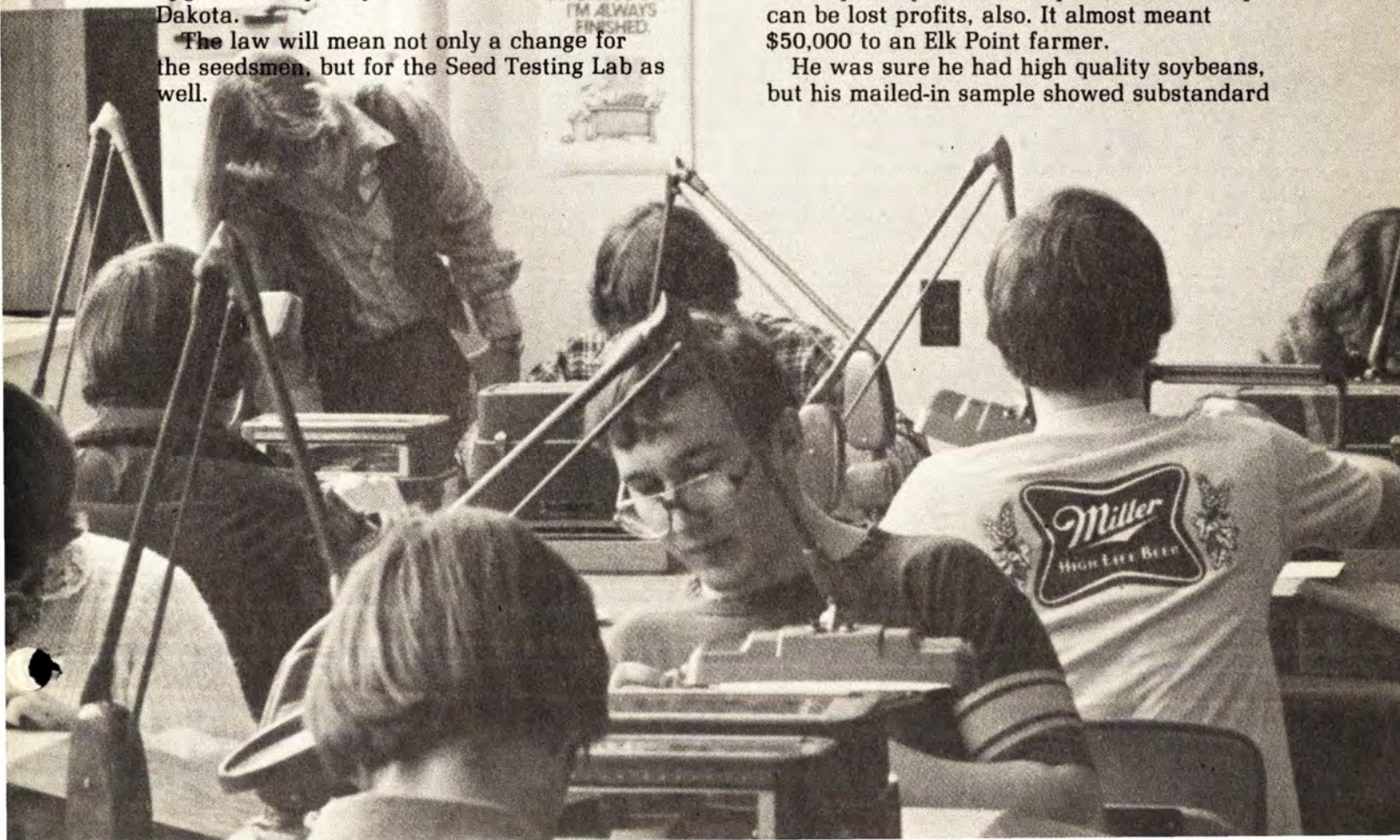
"If a farmer has any reason to believe there might be noxious weed seeds in his seed lot, he must also have the noxious weed test to protect himself. In alfalfa, for example, the purity test involves only a 5-gram sample. In the noxious weed test, we examine 50 grams. He will get a more reliable figure on the larger sample," Lunden said.

Representative, reliable . . .

These are words Lunden emphasizes when referring to the samples. He points out that the tests are accurate for the samples, but the seedsman must guarantee the sample accurately represents the seed lot. The South Dakota Department of Agriculture spot checks samples to insure the reliability of that guarantee. In 1979, 560 samples were tested. The fine for inaccurate labeling is $1,000, in contrast to the $100 fine under the old law.

The penalty for an unrepresentative sample can be lost profits, also. It almost meant $50,000 to an Elk Point farmer.

He was sure he had high quality soybeans, but his mailed-in sample showed substandard



James

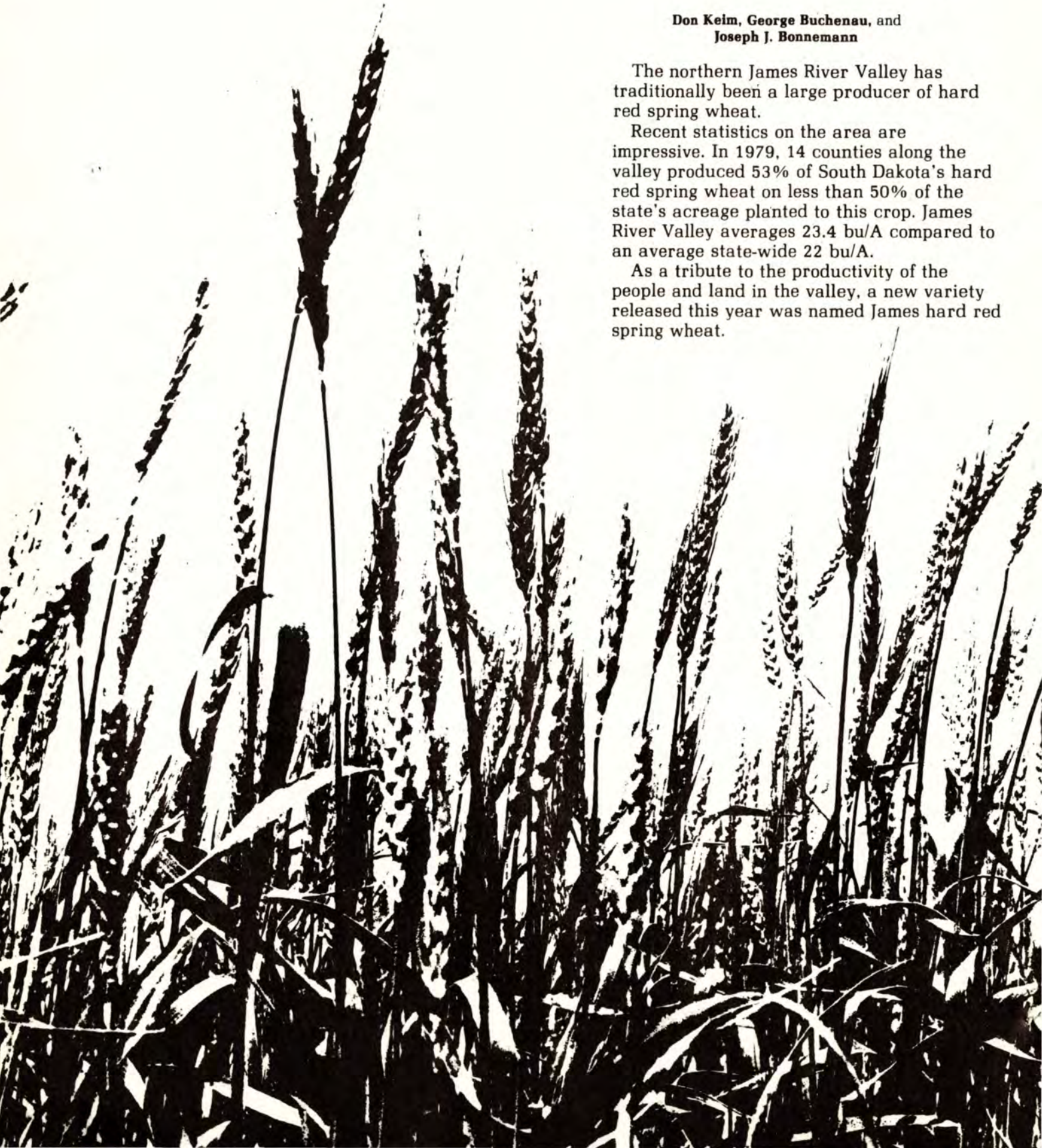
New midtall, early HRS wheat named in honor of the people and land of James River Valley

Don Keim, George Buchenau, and **Joseph J. Bonnemann**

The northern James River Valley has traditionally been a large producer of hard red spring wheat.

Recent statistics on the area are impressive. In 1979, 14 counties along the valley produced 53% of South Dakota's hard red spring wheat on less than 50% of the state's acreage planted to this crop. James River Valley averages 23.4 bu/A compared to an average state-wide 22 bu/A.

As a tribute to the productivity of the people and land in the valley, a new variety released this year was named James hard red spring wheat.



James (C.I. 17791), released March 1, 1979, was developed by the South Dakota Agricultural Experiment Station. James combines good reliable performance, disease resistance, quality, and early maturity.

These characteristics make James a good alternative for producers who wish to plant early, midtall varieties. James should replace some of the acreages sown to World Seeds 1809, Protor, and Waldron.

Seed increased by the Foundation Seed Stock Division, SDSU, was released to seed growers of the Crop Improvement Association for 1979 planting. Registered and Certified seed was available for 1980 planting. Plant Variety Protection has been applied for, and James can only be sold by variety name, as a class of certified seed.

Present seedstocks of James contain tall and awned offtypes totaling no more than 15 per 10,000 plants. Repurification of the original seedstock is presently being acccomplished.

Don Keim, SDSU plant breeder, expects James to replace WS 1809, Protor, and Waldron on some acreages. James is reliable in performance, shows good disease resistance, good overall milling and baking qualities, matures early.

James is midtall, matures early, holds up well in yield comparisons

James is an F_5-derived head selection from the cross OLAF/ND510. The cross was made by plant breeders at North Dakota State University. Initial selection began at Brookings in 1972. Two generations per year were grown during the selection phase until 1975.

James has been tested in breeder yield trials for 6 years at several locations for a total of 49 tests. The Crop Performance Testing Project evaluated the variety at eight locations from 1976 through 1979. James was entered in the Uniform Regional Spring Wheat Yield Nursery for 3 years and grown at 20 locations throughout the northern spring wheat area of the U.S. and Canada. It was evaluated in Crop Quality Council tests at three locations in 1978.

James is a midtall, awned variety of early maturity (Table 1) and heads the same time as Butte and World Seeds 1809. It is one inch shorter than Butte and 2 to 3 inches taller than Era and Olaf.

Thus, James is not classified as a true semidwarf.

The stems and head are yellowish-white when mature. James has good straw strength, and test weights are similar to Olaf and Waldron. James is equal to or better than presently grown varieties in resistance to both stem and leaf rusts. James does not exhibit false black chaff, which is sometimes found in Butte.

Table 1. Uniform Regional Hard Red Spring Wheat Nursery, 1976-1978.

	Yield, bu/A (56)[1]	Test weight, lb/bu (51)	Protein, % (56)	Height, inches (52)	Headed, days (44)	Ripe, days (6)	Lodging, 1-9[2] (26)	Leaf spotting diseases, 1-9[3] (11)	Stem rust, CI[4] (14)	Leaf rust, CI (14)
Era	46.0	60	13.9	27	64	99	1.6	3	0.4	1.8
Len	43.2	60	15.0	29	61	97	1.7	4	0.4	0.8
James	41.3	59	15.0	30	58	94	2.6	4	0.3	0.8
Waldron	40.0	59	15.7	33	60	95	1.7	5	1.4	6.6
Chris	37.0	59	15.4	34	62	98	4.2	4	0.5	2.2
Marquis	32.2	58	15.0	36	63	97	3.5	5	16.5	42.7

[1] Number of stations included
[2] 1 = erect; 9 = completely lodged
[3] 1 = no infection; 9 = severe infection
[4] Coefficient of infection; 0 = no infection

Table 2. South Dakota Standard Variety Spring Wheat Trials, 1976-1979.

	Grain yield								All locations	Test weight, 1979	Plant height, 1979
	Water-town	Bath Groton	Selby	Bison	Quinn Wall	High-more	Brook-ings	Beres-ford			
	bu/A									lb/bu	inches
Early maturity											
James	36.2	20.3	25.5	25.6	27.8	23.0	31.2	24.5	27.0	58	32
Butte	35.6	21.4	21.2	24.6	25.0	23.8	32.5	23.8	26.2	60	33
WS1809	33.0	25.6	25.0	21.9	27.2	23.2	29.5	28.4	26.7	58	27
Medium early/medium											
Protor	36.0	29.6	27.1	24.4	31.5	21.9	30.2	28.4	28.6	58	28
Waldron	35.4	25.4	27.8	25.1	27.4	21.7	29.6	28.3	27.6	57	34
WS 25	35.8	25.9	25.8	25.6	30.3	21.2	30.4	24.1	27.6	57	29
Fortuna	31.4	31.3	24.7	24.3	27.0	23.4	28.3	27.9	26.9	59	35
Medium late/late											
Era	31.9	26.6	26.6	29.5	32.5	22.2	32.8	26.1	28.6	57	30
Eureka	35.4	24.8	27.4	27.7	27.1	22.0	33.4	27.8	28.3	58	35
Olaf	33.9	22.3	26.6	25.0	28.4	24.9	33.1	28.9	28.0	58	31
Kitt	32.8	19.6	25.6	23.9	24.6	19.4	32.4	29.0	26.0	56	30
Chris	27.5	18.8	23.2	22.6	25.6	18.8	28.8	24.0	23.7	58	36

Yield data from the Standard Variety Trials (SVSW), 1976-1979, are presented in Table 2. James performed similar to Butte and WS1809, two early heading varieties. But as a group, the early varieties didn't perform across all locations as well as the later maturity groups.

James performed particularly well at Watertown where yields have been quite high over the past 4 years.

Yield comparisons (based on paired t-tests) from the Breeders Yield Trial (BYT) and the SVSW combined indicated that James significantly outyielded WS1809 by 6% or 1.7 bu/A. Butte significantly outyielded James by 4%. No significant differences were indicated between James and the other varieties with the exception of the comparison with Chris.

Table 3. Expected grain yield in different environments.[1]

Variety	Expected yield,[2] bu/A				Reliability of estimate
	15	25	35	45	(r^2), %
Early maturity					
James	0	+1	+1	+2	85
Butte	0	+2	+4	+5	77
WS1809	+1	0	−1	−2	71
Medium early/medium					
Protor	+2	+1	+1	0	87
Waldron	0	0	0	0	89
Medium late					
Eureka	+1	+1	+2	+2	87
Olaf	0	0	0	0	82
Era	+1	+1	+1	+1	81

[1] Yield regression analysis with location mean yield used as a measure of the environment. Values predicted from Standard Variety Spring Wheat Trials 1976-1979 and Breeders Yield Trials 1975-1979.

[2] Variety yield above (+), the same (0), or below (-) the location mean corresponding to 15, 25, 35, or 45 bu/A.

It is important to predict variety performances at different levels (Table 3). James is expected to yield above average when yield levels are 25 bu/A or greater. James and Butte have yield advantage in better environments, whereas WS1809 and Protor tend to yield better under stress. James has a more reliable performance than Butte and WS1809.

James was planted at three seeding rates (60, 75, and 90 lb/A) at 12 locations in 1978. The 90 lb/A seeding rate gave yields 2.5 bu/A and 1.7 bu/A better than the 60 and 75 lb/A rates ($P < 1\%$ and 10%, respectively).

This suggests that James will perform best when seeded at the higher rate.

James produces slightly lower protein than Waldron, but it is considerably higher than Era (Table 1). In tests with WS1809 and Butte, James had about .2% protein advantage. James has higher flour extraction percentage, lower mixing time and, in some instances, a lower water absorption than Waldron. Overall milling and baking characteristics are considered good, and James will make a positive contribution to the quality of spring wheat in the market place.□

Don Keim is spring wheat breeder and assistant professor; George Buchenau is plant pathologist and associate professor; Joe Bonnemann is specialist in variety testing and assistant professor. All are in the Plant Science Department, SDSU.

Algal bloom

A lake needs fish that eat fish, those that eat algae just recycle nutrients, increase water pollution

Increasing the number of predatory fish would improve the quality of South Dakota lakes, a scientist at SDSU believes.

She also asserts that reducing carp, buffalo, and minnow numbers would improve water quality.

These opinions are based on the research of Dr. Lois Haertel which shows that carp, minnows, and other species of fish eat algae and release it undigested and fertilized.

Haertel, aquatic ecologist in the Biology Department at SDSU, observed that in 1978, after an extensive winterkill of fish, Lake Hendricks "cleaned up" but Oak Lake, which had a surviving minnow population, did not. She observed that lakes which "kill out" have clear water the next year.

That year she did stomach content and fecal content analysis on fish from Oak Lake, Lake Cochrane, and Lake Hendricks.

Her studies at Oak Lake documented that minnows eat algae, do not digest it, but release it and probably fertilize it.

Last summer Darryl Jongsma, Corsica, a graduate student in biology, did a master's thesis on enclosure experiments with perch and minnows and found that both perch and minnows increase the nutrients in the water, increasing the tendency to algal bloom. The experiments showed significant increases in nitrogen, phosphorus, and algae concentrations with either perch or minnows present in the containers.

That carp increase algae has been documented by scientists at the Limnological Research Center at the University of Minnesota. Carp release phosphates into the water, increasing algal bloom, the Minnesota scientists learned. In fact, they discovered that carp do more damage to water quality by releasing phosphates than they do by stirring up the bottom of the lake, which once was thought to be a source of phosphates. On the basis of what research has been done in her department and also at the University of Minnesota, Haertel assumes that all fish

This unsightly layer of "bloom" has been caused by excessively fertile lake water. That, in turn, can be caused by several things, including not enough predator fish and poor soil management on the watershed.

recycle nutrients and increase the algal abundance.

That doesn't mean that she would recommend ridding the lakes of all fish for the purpose of clearing the water. But she would increase the numbers of predatory fish such as northern pike, walleyes, and muskies and decrease the population of forage fish, bringing them into a better balance.

A lake full of stunted perch would increase the algal bloom, but predatory fish would improve the water quality by reducing the biomass.

She also supports reduction of carp and buffalo populations by keeping them out with carp barriers.

"The message is that there is a real possibility we could do something to improve our lakes through fish management. This would improve water quality and reduce algal bloom," she said.

She supports commercial fishing for carp and buffalo—getting rid of the rough fish—while acknowledging that there is a lot of public opposition to commercial fishing for carp and buffalo, mainly based on two reasons: that trawling stirs the bottom, and that a few game fish might be taken also.

She says she can document that wind-generated waves also stir the bottom sediments in shallower lakes. She doesn't believe bottom stirring by commercial fishermen in those lakes, especially when done in the winter, is serious enough to prohibit their fishing.

And she also answers that there is considerable scientific opinion that carp may be competing for some of the same sources of food as game fish, so removal of carp may benefit some of the game fish.

Haertel's studies at Lake Hendricks documented that after the fish winterkill the winter of 1977-78, water quality improved 75% in terms of algae contamination. Lake Poinsett also cleaned up after the 1977-78 winterkill, she said.

The implications of the effect of winterkill on water quality are that by either winterkill or removal of carp, both reducing rough fish populations, algae content will decrease, and winterkill in subsequent years will be less severe. Algae play a part in winterkill. When lakes are snow covered, algae don't grow to produce oxygen through photosynthesis, instead they decompose, using up oxygen.

Rough fish aren't only reasons for bloom; watersheds contribute too

Algae are a more serious problem than most people realize, says Haertel. Algae can release toxins and kill cattle and dogs or even people if they drink it. But it's only during an occasional heavy bloom that algae produce these toxins, she said.

Haertel is aware that nutrients supplied to algae by fish is not the only reason lakes turn green. There can be inputs, too, from surrounding cropland, from cattle waste, building and road construction, and in the case of Lake Poinsett from the Big Sioux River running through the lake.

A principal tool in improving water quality in South Dakota lakes may be fish management, such as introducing more predatory fish and seining for carp and buffalo. In addition, farm runoff and construction should be controlled, she said. □

The writer is Jerry Leslie, information specialist, Ag Information Office.

Publications off the press

The Agricultural Experiment Station and the Cooperative Extension Service distribute a large variety of publications to South Dakota citizens. Your county Extension office has free single copies for you.

These publications list the new and revised subjects off the press between December 1, 1979, and May 15, 1980.

FS 418, Beef cattle performance testing (rev)
FS 722, Wood burning stoves
FS 723, Fireplaces
FS 745, Protecting trees from animal and bird damage
FS 753, Interpreting individual cow somatic cell counts
FS 754, Feed analysis
FS 755, Irrigating crop production costs
FS 758, Dakota proposition
EC 632, 10 steps in planning your farm or ranch business (rev)
EC 687, Apple and pear disease control (rev)
EC 727, Motivation
EC 728, Communications
EC 730, Irrigating alfalfa
EC 732, Budgeting procedures for community services
ESS 27, Endangered species packet
B 661, Barley in South Dakota
B 670, Rebound
C 230, Credit conditions after the 1976 drought
C 231, 1979 corn performance trials
C 232, 1979 grain sorghum performance trials
TB 54, Study of resident water demand in and around the Big Sioux Basin
TB 55, Branchline abandonment

Out-of-state residents may obtain FS and EC publications for 15 cents each unless otherwise indicated, B,C. and TB series for 25 cents each unless otherwise indicated. Remittance is required in advance of shipment. Remittance from foreign countries should be made by international money order payable to Ag Publications No 6287-9101, by draft on American or Canadian bank. It is necessary to include an additional 25% of the total cost of publications ordered to cover foreign postage. Send to Extension Bulletin Room, SDSU, Brookings, SD 57007.

Correction:
No overnight answers, *Farm & Home Research* 31(2):9, paragraphs 6 and 7. Substitute the following: Sugar diets cause small but significant increases in total liver fats and phospholipid. Total blood fat levels were higher with corn oil diets, but only when the rats were fed as much as they cared to eat.

Photo, page 3, courtesy Valmont Industries

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B.L. Brage, Director, Resident Instruction
R.A. Moore, Director, Experiment Station
Hollis D. Hall, Director, Extension Service

Farm & Home Research
John L. Pates, Department Head
Mary Brashier, Editor
Duane Hanson, Designer

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